ORIG

Before the **Federal Communications Commission** **Washington, D.C., 20554**

In the Matter of	)	NPRM No. WT 97-12
	)	
Amendment of the Amateur Service Rules	)	
to Provide For Greater Use of Spread	)	
Spectrum Communication Technology	)	

REPLY COMMENTS BY ROBERT J. CARPENTER

Submitted: 4 June 1997

INTRODUCTION

I, Robert J. Carpenter, hold amateur radio license W3OTC, and have operated on the amateur VHF and UHF allocations nearly exclusively for almost 50 years. As an electronic engineer, I have been professional involved in digital and packet communication intermittently since 1951. As a radio amateur, I took part in the first 50 MHz amateur meteor burst packet communication. I am a Life Member of the American Radio Relay League (ARRL) and of the Radio Amateur Satellite Corporation (AMSAT).

These Reply Comments address Comments filed by Phillip Karn, Robert Buaas, Tucson Amateur Packet Radio (TAPR), Lyle Johnson, William Tynan, Raphael Soifer, the Central States VHF Society, the Radio Amateut Satellite Corp (AMSAT), the American Radio Relay League (ARRL), Metricom, and the Part 15 Coalition.

GENERAL

I believe that the nearly-unfettered use of Spread Spectrum (SS) on all or most amateur radio allocations, as proposed in the Karn, Buaas, and TAPR Comments, is very premature. Since actual field experience of use of SS by the amateur community is essentially nonexistent, and never formally reported, limitation of ***Wideband*** SS to bands above 420 MHz would appear sensible at the present time. As field experience is obtained, this limitation can be revisited.

As I demonstrated in the Comments, automatic power control (APC) will further exacerbate the problem of interference from SS to other amateur users, and represents useless over-regulation. The TAPR and Buaas proposals to remove the proposed 100 W power limit for SS users would make the problem even worse.

Because of the likelyhood of interference to other amateur operations, and the current lack of *de facto* standardization of amateur SS, it is important that SS stations transmit station identification in a manner that can be clearly understood by non-SS amateurs.

AUTOMATIC POWER CONTROL AND INTERFERENCE

The ARRL and the FCC propose that automatic power control (APC) be required for SS stations using more than one watt. Essentially all the Comments argue that APC will be unworkable in the amateur

environment, and I argue that it will actually increase interference. Raising the genreal power limit for SS above 100 W would make the problem even worse. Please refer to my original Comments on this proceeding. The assertions by the ARRL that APC will reduce interference are incorrect, as shown by that straight-forward analysis.

Buaas says:

> To date, no one has come forward with any evidence that Amateur SS emissions have interfered with anyone.

But what he doesn't say is that there has been infinitestimal on-the-air amateur use of SS. The examples he quotes are for FHSS on the output frequency of FM repeaters. In this case the non-SS signal is strong and easy for the FHSS stations to hear and avoid. In the case of weak-signal, EME, and satellite users, the FHSS system would be unable to hear the weak signals and would thus use their frequencies and cause serious interference.

Yes, SS has been authorized. No, essentially no one has used the authorization. The lack of reported interference to other modes is a disingenuous argument. Since the FCC allowed operation under STAs without identification that could be understood by non-participants, and with no prior or post notification of the amateur community sharing the bands, it is hardly surprising that no interference from these tests has been reported.

NARROW BAND SPREAD SPECTRUM

All of the previous discussion of DSSS has assumed high data rates and wide bandwidths, and its use for very local communication. Thomas A. Clark and Phillip Karn presented a very interesting unpublished paper at the 1996 Conference of the Central States VHF Society. They proposed that techniques which are essentially DSSS be used for extremely weak signal amateur operations such as communication by reflection off the Moon. Their proposal envisions a maximum data rate of a few bits per second, spreading over only a few kilohertz, and use of the usual maximum amateur power in the vicinity of one kilowatt output. It would be a mistake for the FCC to adopt Rules which prevent this type of advanced operation.

How can the above exciting use of DSSS be accommodated in the Rules, without the disastrous consequences that wideband DSSS would cause if allowed in the weak-signal band segments? The obvious solution is to define Narrow Band Spread Spectrum (NBSS). The FCC has a long history of allowing new modes *if they occupy no more bandwidth than the existing modes used in that band-segment.* I understand that William Tynan will propose a similar class of NBSS. The bandwidth allowed (or commonly used) in VHF and UHF weak signal voice and MCW subbands is no more than 10 kilohertz. I propose that the bandwidth of NBSS be limited to 10 kHz. In order to be useful, the power limit for NBSS must be the same as for the other narrow band weak signal and FM users, not the 100 watts proposed by the FCC for wideband SS, or my proposal for a one-watt limit for wideband SS..

Since NBSS uses approximately the same spectrum width as the more traditional modes such at narrow FM, MCW, etc., I feel that it should be authorized on all amateur frequencies above 50 MHz where MCW is authorized.

BANDS FOR SS USERS

Comments by Soifer, Tynan, Central States, and AMSAT, argue that weak signal and satellite users need protection from routine wideband terrestrial SS operation. I generally accept many of the frequency and use recommentations they have made. A major exception is that I feel strongly that no form of SS should be authorized in the CW-only sections of any amateur band. As you will have noted, I feel that Narrow Band SS should be authorized on all amateur band segments above 50 MHz where MCW is authorized.

IDENTIFICATION OF SPREAD-SPECTRUM TRANSMISSIONS

Since my filings on this Proceeding and RM-8737 point out a high likelyhood of interference from SS to other amateurs users, it is vital that the source of the SS transmissions be identified. Without this identification, the cooperative solution of the interference within the amateur community will be extremely difficult.

Karn says:

> Indeed, given the overall industry trend toward more flexible, dynamic and efficient usage of radio spectrum, the creation of effective cooperative procedures for interference mitigation is itself an opportunity for the amateur service to contribute significantly to the state of the radio art.

Existing band users should not have mount full-scale direction-finding expeditions to find the source of other amateur transmissions. Lack of an identification readable by present users would put SS users in the same category as illegal users of the amateur bands, as far as other amateurs are concerned. SS does not need this stigma.

When ***de facto*** standards for amateur SS become widely used, the non-SS identification requirement can be removed. This two-step approach has been successful in the progress of amateur packet radio.

Johnson states:

> Many commenters to the original proposal expressed concerns about potential interference to narrowband users. Others pointed out that many SS stations could coexist with many narrowband stations over the same overall spectrum without mutual interference. To allay the fears of the former, and allow demonstration of the benefits of the latter, SS emissions must necessarily be "invisible" to a narrowband station's receiver.
>
> But, we have in place a rule that requires the SS station to operate in a way that guarantees the emission will be heard by narrowband receivers!

Mr. Johnson goes on to describe amazingly complex scenarios of separate transmitters for identification, etc.

Surely the Rule says no such thing. It merely requires that, if the signal is of sufficient strength [to cause interference], that it should be identified in a way that is detectable by non-SS receivers. It

should be noted that the existing identification requirement does not require that a narrow-band signal be used for identification. In fact such a requirement would be nearly useless, since the choice of the exact frequency for identification would be difficult to specify. DSSS transmissions should be identified by on-off keying of the SS signal, as mentioned by Karn in his Comments. No interference exists if the spectral density of the DSSS signal is insufficient to allow reading of the on-off keyed identification.

Frequency hopping SS (FHSS) requires a different approach. What frequency should be used to transmit the identification? I suggest that the transmitter dwell on the lowest frequency of the hopping sequence during the 3 or 4 seconds required to send the on-off keyed identification.

LOG-KEEPING REQUIREMENTS FOR SS STATIONS

Johnson and others complain that the requirements of §97.311 (e) and (f) are onerous and will impede SS operation and experimentation. I accept his complaints, but only if SS transmissions continue to be identified in a manner that can be read by non-SS receivers.

INTERFERENCE TO AND FROM UNLICENSED SERVICES SHARING AMATEUR BANDS

Comments by the Part 15 Coalition and by Metricom view with alarm potential interference to their unlicensed use of the 915MHz and 2.4 GHz bands. As the these bodies, and the FCC, are well aware, their use of these bands is on the basis that they must accept any and all intereference caused to their unlicensed operation by the primary (ISM) and secondary (amateur) user of these bands. In addition, they are forbidden to cause interference to the higher-priority users (amateur) of these bands. The present time is extremely late in the day for the Part 15 Coalition and Metricom to complain that their operation has no legal protection from interference. They certainly have a careless business approach if they based their company on the ***hope*** that amateurs would not heavily use these amateur allocations. The FCC should reject the Comments of the Part 15 Coalition and Metricom as not having any standing in this Proceeding.

In addition, the FCC should agressively enforce its Rules that require that the unlicensed users not interfere with the amateur users of the 915 MHz and 2.4 GHz bands.

RECOMMENDED MODIFICATIONS TO PART 97 OF THE RULES

Based on my earlier recommendations, modified by consideration of the point made by others in the Comments, I recommend that Part 97 of the Rules be modified as shown below. **As a basis, I am using the changes proposed by the FCC in the subject NPRM.** My additions are shown in ***bold italics***. Deletions are enclosed in [brackets].

---

§97.119 (b) (5) Identification of SS Transmissions.

SS transmissions which simultaneously occupy essentially all of the spreadsing band (DSSS) shall be identified by morse keying some characteristic of the entire emission at a rate not exceeding 20 words per minute, in a manner as to be discerable by non-SS receivers. SS transmissions which sequentially hop from one frequency to another (FHSS) shall be identified by having the transmitter dwell on the

lowest frequency in the hopping sequence for the duration of the identification, which shall key some characteristic of the signal so as to be discerable on non-SS receivers.

§97.305 Authorized Emission Types

(a) - (c) (modified per AMSAT,Central States, Tynan, Soifer, etc, et al, except that no SS should be allowed in CW-only subbands, 50.0-50.1, 144.0-144.1)

(d) SS emission transmissions which occupy a total bandwidth of no more than 10 kHz may use any amateur frequency above 50 MHz where MCW emission is authorized.

§ 97.311 SS emission types.

(a) SS emission transmissions by an amateur station are authorized only for communications between points within areas where the amateur service is regulated by the FCC and between an area where the amateur service is regulated by the FCC and an amateur station in another country that permits such communications. SS emission transmissions must not be used for the purpose of obscuring the meaning of any communication.

(b) A station transmitting SS emissions must not cause harmful interference to stations employing other authorized emissions, and must accept all interference caused by stations employing other authorized emissions.

(c) Reserved.

(d) Reserved.

(e) Reserved [present text eliminated only if a non-SS identification is required.]

(f) Reserved [present text eliminated only if a non-SS identification is required.]

(g) The transmitter power must not exceed ***1 W if the SS emission occupies a bandwidth of greater than 10 kHz.***

The following to be removed:
[100 W under any circumstances. If more than 1 W is used, automatic transmitter control shall limit output power to that which is required for the communication. This shall be determined by the use of the ratio, measured at the receiver, of the received energy per user data bit (Eb) to the sum of the received power spectral densities of noise (N_0) and co-channel interference (I_0). Average transmitter power over 1 W shall be automatically adjusted to maintain an $Eb/(N_0 + I_0)$ ratio of no more than 23 dB at the intended receiver .]

Respectfully submitted,

Robert J. Carpenter

4 June 1997 (Copies will be sent to parties commented upon.)